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AN ESTIMATE OF THE POPULATION OF DEER-MICE IN THE BLACK HILLS OF SOUTH DAKOTA AND WYOMING

BY LEE R. DICE

INFORMATION about the number of individual animals in a local population or concerning the total number in a race or species is often desirable in connection with ecologic and economic studies. Such information is also needed in calculations of the possible rate of evolution of hereditary characters.

As an example of a possible method of calculating the size of a population of small mammals an attempt is made in this paper to estimate the number of deer-mice (*Peromyscus maniculatus osgoodi* Mearns) living in the Black Hills of South Dakota and Wyoming during the late summer of 1935. The field study on which the calculations are based was sponsored by the Carnegie Institution of Washington.

A map of the vegetation of the Black Hills, published by O. E. Guthe (1935 : 354), gives a basis for calculating the area covered by each vegetation type. The large-scale map from which the published figure was made was kindly loaned to me by Dr. Guthe, and Margaret Liebe made planimeter measurements of the area covered by each type of vegetation (Table II).

In the Black Hills deer-mice occur most abundantly in the forests. The plains which surround the Hills are covered mostly by grass. In the grassland to the east and to the south deer-mice were extremely scarce in 1935. It is possible that the area to the west and northwest, which I did not see, offers somewhat more favorable habitats for deer-mice. Nevertheless, the deer-mouse population in the Black Hills is to a large extent isolated.

The various types of habitat that occur in any region are not all equally suitable for a given species of animal, and the number of individuals of the species per unit area varies, therefore, with the type of ecologic community. It is accordingly necessary in any calculation of the size of an animal population to measure the areas covered by each ecologic type in the region studied and to determine the average number of individuals of the species under consideration per unit area in each different ecologic type.

Not all of the vegetation types occurring in the Black Hills could be trapped in the time available for field work. Furthermore, the information about the ecologic communities which I was able to study is far from being complete. Nevertheless, the data obtained allow one to make a rough estimate of the total population of deer-mice.

TABLE I

Estimated population density of the deer-mouse in certain habitats in the Black Hills

All adults and subadults assumed to have fixed home ranges

Habitat	Locality	Date 1935	Mice Taken	Mean Width of Cruising Range in Feet		Number Mice per Acre				Total Mice per Square Mile
				♂♂	♀♀	♂♂	♀♀	Juv.	All	
Yellow pine, dense	Medicine Mt.	Aug. 13–23	19	285	285	.54	.54	.38	1.46	932
Yellow pine, medium ...	Medicine Mt.	Aug. 26–31	10	405	204	.27	1.04	.09	1.40	894
Aspen and yellow pine	Medicine Mt.	Aug. 26–31	2	....	796	......	.14	......	.14	88
Yellow pine, sparse ...	Rockerville	Sept. 1–5	5	554	314	.33	.44	......	.77	492
Yellow pine, young ...	Rockerville	Sept. 2–6	3	....	314	......	.44	......	.44	282

The number of deer-mice per unit area in each of the several vegetation types has been calculated from the numbers trapped in measured quadrats by a method recently described (Dice, 1938 : 123–25). This method attempts to estimate from the number of individuals of each sex and age class taken within a setting of traps the total area from which the animals have come to the traps.

None of the quadrats which I trapped in the Black Hills were sufficiently large to contain enough adult deer-mice of either sex for fully satisfactory estimates of population. I now realize that the quadrats should have been much larger in size. Furthermore, in late summer, when the trapping was done, it was impossible to determine whether or not the young animals in subadult pelage were occupying established home territories of their own. Deer-mice in subadult pelage often are sexually mature, and in calculating the average width of a home range I have therefore combined the adults and subadults of each sex. The juvenile mice taken in each quadrat are assumed to have come from the same area outside the quadrat as the adult and subadult males. One other assumption has been necessary. The age and sex of two mice taken in two quadrats located in medium dense yellow pine and in mixed aspen and yellow pine, respectively, near Medicine Mountain, failed to be recorded, but one of these mice is known to have been a subadult female. In the calculations both are assumed to have been subadult females.

The greatest abundance of deer-mice in the Black Hills occurs in the dense and medium dense stands of western yellow pine. This is the most widespread type of vegetation in the Black Hills. For calculating the number of deer-mice in this vegetation type I have used the mean population density, 913 per square mile, given by two quadrats, one in fairly dense yellow pine, 932 mice per square mile, and one in medium dense yellow pine, 894 mice per square mile, both near Medicine Mountain (Table I). These quadrats were both located on the upper parts of the mountains, and it is possible that the average number of deer-mice in this situation is greater than in similar habitats at lower elevations. For the spruce type; cottonwood, ash, elm type; medium to dense oak–pine type; and mountain mahogany and skunk bush type of Guthe the same population density of deer-mice has been assumed as in the medium to dense yellow pine type (Table II).

The concentration of deer-mice in the sparse yellow pine type of Guthe has been assumed to be the same as in a quadrat trapped in a rather open stand of yellow pine near Rockerville. For his scattered yellow pine type the same population density has been assumed as in a scattered stand of young yellow pine, also located near Rockerville (Table I). The sparse oak–pine type has been assumed to have the same deer-mouse concentration as the scattered yellow pine type. The concentration in the large burns type of Guthe has been assumed to be the same as in a mixed aspen and yellow pine quadrat trapped near Medicine Mountain. No trapping was carried on in grassland, pasture, or cultivated fields. It is probable that in the higher mountains a few deer-mice occur in these types of habitats, particularly if there were brush or rocks available for cover. However, around Rapid City and south of Hot Springs, where I did trap in grassland, deer-mice were extremely scarce. It has been assumed, therefore, that no deer-mice occur in this vegetation type.

The total number of deer-mice living in the Black Hills during late August and early September, 1935, is calculated to be about 2,500,000 (Table II). No pretense is made that this number is near the actual number in the population. The total deer-mouse population of the Black Hills might well have been at that time considerably more than 2,500,000, perhaps even twice as much. It is more likely that the actual population was less than the estimate, because my calculations are based mostly on trap quadrats in the higher parts of the mountains, where the mice seem to be somewhat more numerous than at the lower elevations. The deer-mouse population of the Black Hills might, therefore, have consisted at that time of 2,000,000 or perhaps of as few as 1,000,000 individuals.

TABLE II

Population of deer-mice in the Black Hills during late summer, 1935

Vegetation Type	Average Number of Mice per Square Mile	Square Miles Covered*	Total Mice, Estimated
Yellow pine, medium to dense	913	2,012	1,836,956
Spruce	913	15	13,695
Cottonwood, oak, ash, elm	913	47	42,911
Oak–pine, medium to dense	913	198	180,774
Mountain mahogany and skunk bush	913	29	26,477
Yellow pine, sparse	492	838	412,296
Yellow pine, scattered	282	63	17,766
Oak–pine, sparse	282	469	132,258
Large burns	88	82	7,216
Grassland, pasture, and cultivated	00	1,215	....
Grand total		4,968	2,670,349

* Calculated from map of Guthe.

At other seasons and in other years the deer-mouse population of the Black Hills would certainly be different in size from that in the late summer of 1935. Probably a few additional young mice would be added to the population during September and October. In the spring, before the advent of the young of the year, the number of mice would of course be much less than in summer. We know little about annual fluctuations in the numbers of these animals, but it is almost certain that variations from year to year also occur.

SUMMARY

The total population of the deer-mouse, *Peromyscus maniculatus osgoodi,* in the Black Hills during the late summer of 1935, is estimated from trapping records to have been between 1,000,000 and 5,000,000 individuals.

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